

**SENSOR INTEGRATED HAPTIC DEVICE  
AND METHOD FOR MANUFACTURING  
THE SAME**

**CROSS-REFERENCE TO RELATED  
APPLICATION**

[0001] This application claims the benefit under 35 USC 119(a) of Korean Patent Application No. 10-2015-0134568 filed on Sep. 23, 2015, in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference for all purposes.

**BACKGROUND**

[0002] The present disclosure relates to an ionic elastomer-based sensor integrated haptic device and a method for manufacturing the same.

[0003] Recently, according to the needs of users wanting to easily use electronic devices, touch input type devices have been generalized. Among the touch input type devices, a haptic feedback device provides feedback of a touch and thus provides a more intuitive experience to a user. Such a haptic feedback device facilitates space saving, convenience in manipulation, easy recognition by a user, and interworking with IT devices.

[0004] There has been known a method of using a piezoelectric element as a material for implementing the haptic feedback device. As piezoelectric materials constituting the piezoelectric element, piezoelectric ceramic and a piezoelectric film have been known. Generally, piezoelectric ceramic has a high stiffness and thus has been used as an actuator, and a piezoelectric film has high sensitivity and flexibility and thus has been used as a sensor. However, the piezoelectric materials cannot provide adequate force and displacement in a low frequency range, and the piezoelectric materials in a single unit provide very small force and displacement. Therefore, it is difficult to use the piezoelectric materials as an actuator.

[0005] In this regard, there have been disclosed techniques such as Korean Patent Laid-open Publication No. 2011-0077637 (entitled "Piezoelectric actuator actuating haptic device").

[0006] Conventionally, various devices have been used in order to implement various sensors such as a touch sensor, a pressure sensor, and a temperature sensor and actuators capable of providing feedback of tactile sensation. Accordingly, there is an increase in cost due to a complicated process and there is also a limit to durability of the haptic feedback device. Such demerits affect the process cost and yield when a touch sensor is integrated with a display panel or a cover glass in order to minimize a display. Further, even when a sensor and an actuator are configured as separate layers in order to implement various functions, the process cost may be increased and a thickness of a display panel may be gradually increased.

**BRIEF SUMMARY**

[0007] Some exemplary embodiments of the present disclosure provide an ionic elastomer-based haptic device in which a sensor and an actuator are integrated with each other, and a method for manufacturing the same.

[0008] However, problems to be solved by the present disclosure are not limited to the above-described problems. There may be other problems to be solved by the present disclosure.

[0009] In accordance with an exemplary embodiment of the present disclosure, there is provided a sensor integrated haptic device. The device may include a sensor; and an actuator formed to be arranged on the same plane as the sensor. Herein, each of the sensor and the actuator may include a lower electrode formed through a first process, an ionic elastomer layer formed on the lower electrode through a second process, and an upper electrode formed on the ionic elastomer layer through a third process.

[0010] Further, in accordance with another exemplary embodiment of the present disclosure, there is provided a method for manufacturing a sensor integrated haptic device. The method may include: forming lower electrodes of a sensor and an actuator in a predetermined sensor region and a predetermined actuator region, respectively, on a substrate; stacking ionic elastomer layers on the lower electrodes; and forming upper electrodes on the ionic elastomer layers. Herein, the sensor region is arranged to be adjacent to at least a part of the actuator region or surround the circumference of the actuator.

[0011] In accordance with yet another exemplary embodiment of the present disclosure, there is provided an electronic device including a sensor integrated haptic device. The electronic device may include: multiple sensor integrated haptic devices each including a sensor and an actuator formed to be arranged on the same plane as the sensor; a power supply line configured to supply power to each actuator; and a transmission line configured to transmit a sensing voltage to each sensor. Herein, each of the sensor and the actuator may include a lower electrode formed through a first process, an ionic elastomer layer formed on the lower electrode through a second process, and an upper electrode formed on the ionic elastomer layer through a third process.

[0012] According to the above-described exemplary embodiment of the present disclosure, a sensor integrated haptic device can sense an external environment and provide mechanical feedback at the same time, and can also be easily manufactured in the form of an array. Therefore, the sensor integrated haptic device can be conveniently applied to various application fields such as a touch panel of a display.

[0013] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0014] In the detailed description that follows, embodiments are described as illustrations only since various changes and modifications will become apparent to those skilled in the art from the following detailed description. The use of the same reference numbers in different figures indicates similar or identical items.

[0015] FIG. 1A is a schematic diagram of a sensor integrated haptic device in accordance with an exemplary embodiment of the present disclosure.